

Implementation of California Phase 3 Reformulated Gasoline

Workshop on Ethanol & Alkylates in Fuels

April 10, 2001

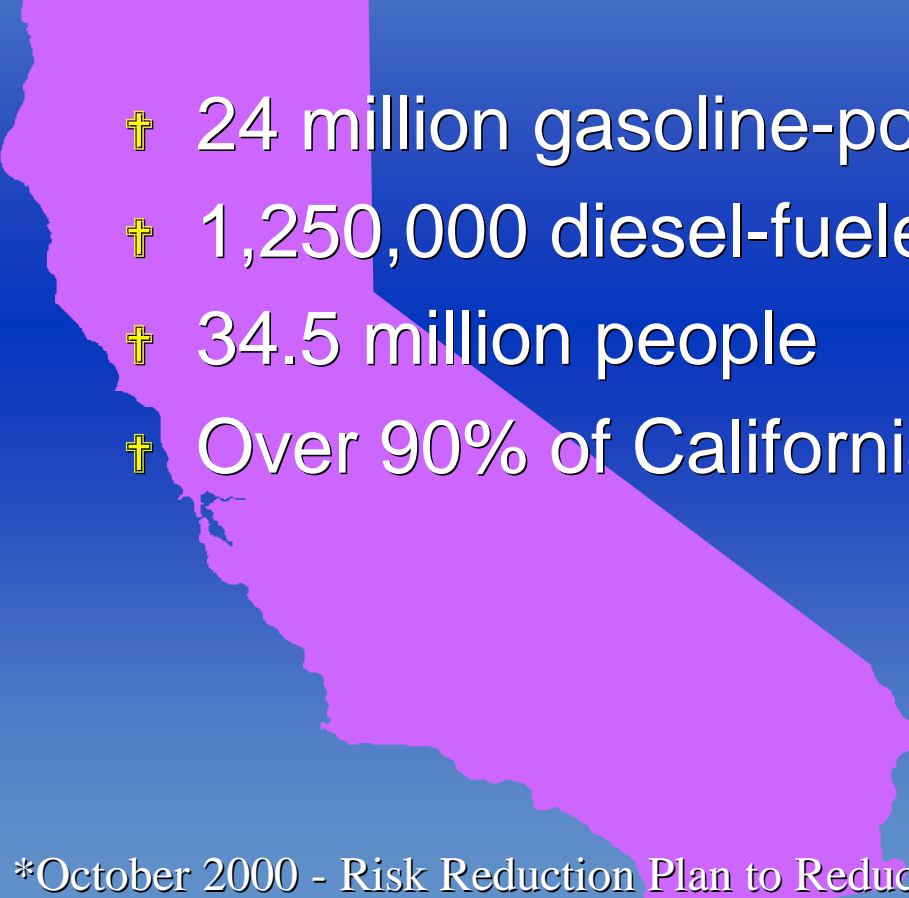
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California Environmental Protection Agency



Air Resources Board

California's Air Quality Problem

- 
- † 24 million gasoline-powered vehicles
 - † 1,250,000 diesel-fueled vehicles and engines*
 - † 34.5 million people
 - † Over 90% of Californians breath unhealthy air

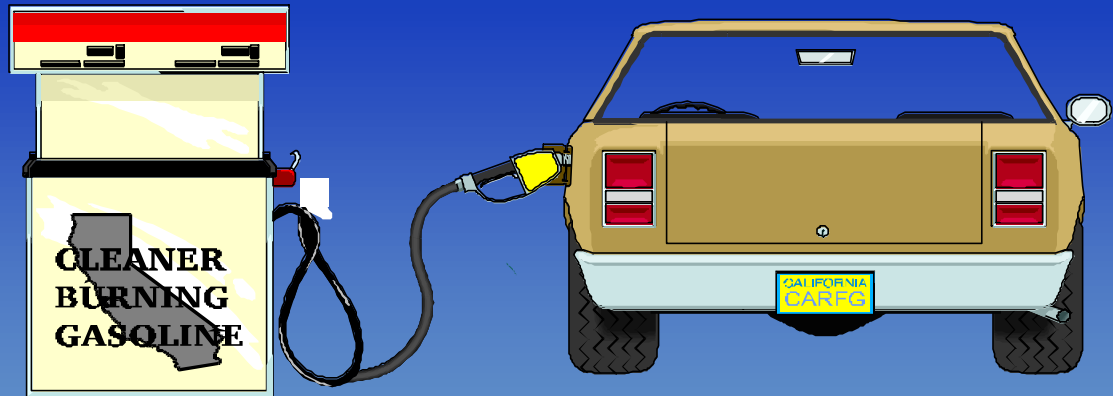
*October 2000 - Risk Reduction Plan to Reduce PM Emissions from Diesel-Fueled Engines and Vehicles

California Clean Air Act Requirements for Mobile Sources

- † Achieve maximum feasible reductions in PM, CO, and toxic air contaminants
- † Achieve maximum emission reductions of VOC and NOx by earliest practicable date
- † Adopt most effective combination of control measures on all classes of motor vehicles and their fuels

Motor Vehicle Fuels Control Strategy

- † Treat vehicles / fuels as a system
 - Vehicle emission standards
 - Fuel standards
- † Flexible



California's Vehicle Fuels Programs

Year Adopted	Gasoline	Diesel	Alternative Fuels
1971	Reid Vapor Pressure	-----	-----
	Bromine Number	-----	-----
1975	Sulfur	-----	-----
	Manganese/Phosphorus	-----	-----
1976	Lead	-----	-----
1981	-----	Sulfur (SCAB)	-----
1982	Lead	-----	-----
1988	-----	Sulfur/Arom. HC	-----
1990	Phase 1 RFG	-----	-----
	-----	-----	Clean Fuels/LEV
1991	Phase 2 RFG	-----	-----
	Wintertime Oxygenates	-----	-----
1992	-----	-----	Commercial and Certification Specs
1994	Phase 2 RFG Predictive Model	-----	-----
	-----	-----	LPG (amended)
1998	Combustion Chamber Deposits (amended)	-----	-----
	Wintertime Oxygenates (amended)	-----	-----
	-----	-----	LPG (amended)
1999	Wintertime Oxygenates (amended)	-----	-----
	-----	-----	Clean Fuels (amended)
2000	Phase 3 RFG(eliminates MTBE)		

Summary of Fuels Program Benefits

Program	Emissions Reductions (tpd)					
	HC	NO _x	PM	SO _x	CO	Toxics
Diesel (1993)	--	70	20	80	--	25%
CaRFG1 (1992)	210	--	--	--	--	--
CaRFG2 (1996)	190	110	--	30	1300	40%
CaRFG3 (2003)	0.5	19	--	4	--	7%
Total (tpd)	400	190	20	114	1300	na

California Phase 2 Gasoline (CaRFG2) Program

- † Adopted in 1991
- † Implemented March 1996



- † Limits on the following parameters:

Sulfur
T50
T90
Olefins

RVP (Summertime)
Benzene
Aromatic Hydrocarbons
Oxygen Content

CaRFG2 Specifications

	Typical Before CaRFG2	Flat Limit Standard	Average Standard	Cap for All Gasoline
RVP, psi	7.8	7.0	-	7.0
Sulfur, ppmw	150	40	30	80
Aromatic HC, vol%	32	25	22	30
Benzene, vol%	2.0	1.0	0.8	1.2
Olefins, vol%	9.9	6.0	4.0	10.0
Oxygen, wt%	0	1.8-2.2	--	1.8 ¹ -2.7
T90, deg F	330	300	290 ²	330
T50, deg F	220	210	200	220

¹ Wintertime only

² Refinery cap = 310 deg F

Typical Properties¹ of CaRFG2

RVP, psi	6.8
Sulfur, ppmw	22
Aromatic HC, vol%	23
Benzene, vol%	0.6
Olefins, vol%	4.5
Oxygen, wt%	2.0
T90, deg F	310
T50, deg F	201

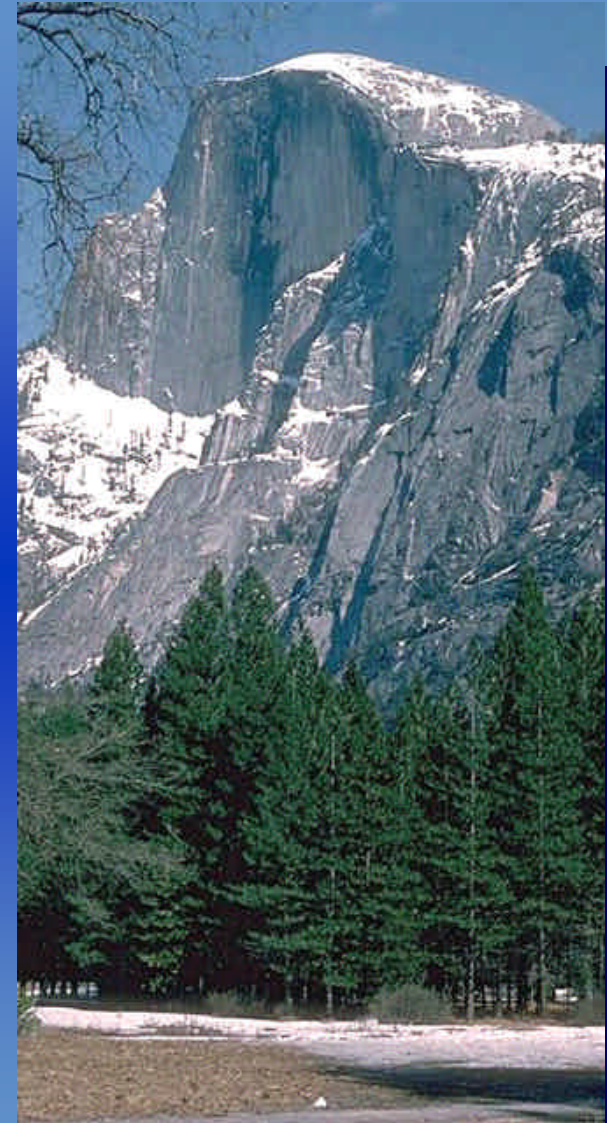
¹ Based on 1999 CEC ARB survey of California refiner's summertime fuel

Compliance Options

- † Meet “flat” limit standards
- † Meet “average” limit standards
- † Produce formulation certified as equivalent through:
 - Emissions testing
 - Predictive model (flat or average limits)
- † Essentially all California reformulated gasoline is now being marketed using the Predictive Model

Benefits of CaRFG2

- † Emission reductions equivalent to removing 3.5 million vehicles from region's roads
- † Reduces smog forming emissions from motor vehicles by 15%
- † Reduces potential cancer risk from vehicle emissions by 40%
- † 1/4 of SIP reductions in 1996
- † Reduces benzene emissions by half



Federal Reformulated Gasoline (RFG) Program

- † Required by 1990 CAAA in severe and extreme ozone non-attainment areas
- † Minimum oxygen requirement of 2.0 weight percent
- † Performance based fuel standards
- † Phase 1 federal RFG
 - Required as of January 1, 1995
- † Phase 2 federal RFG
 - Required January 1, 2000
- † Sulfur reduced to an average of 30 ppm in 2004



The Governor Directed the Use of MTBE to Be Phased Out of Gasoline

† Based on study by University of California, and public hearings Governor found:

- MTBE in small amounts presents threat to groundwater, surface water, and drinking water
 - Underground gasoline storage tanks are not leak proof
 - MTBE is highly soluble in water and transfers to groundwater faster than other constituents in gasoline
- MTBE potential but not proven health problem
- MTBE not essential to cleaner-burning gasoline

Governor's Executive Order



- † Directed that the use of MTBE be phased out by December 31, 2002
- † Adopt CaRFG regulations to:
 - Provide additional flexibility in removing oxygen
 - Preserve benefits
- † Directs ARB to request waiver from Federal Oxygen Requirement from U.S. EPA

State Legislation

- † Senate Bill 989 (Sher)
 - Ensure the CaRFG3 regulations maintain or improve upon emissions and air quality benefits
- † Senate Bill 529 (Bowen)
 - Multi-media review of revisions to ARB's CaRFG standards

Air Resources Board Took Action to Implement the Governor's Directive to Phase Out MTBE

- ✚ In 1999, the ARB amended California's gasoline regulations to phase out the use of MTBE by December 31, 2002

CaRFG3 Regulations

- † Approved on December 9, 1999
- † Implemented the Governor's Executive Order
- † Meets requirements of the Sher Bill and the Bowen Bill
- † Removes MTBE from California gasoline December 31, 2002
- † Provides additional flexibility to remove MTBE
- † Enhances emission benefits of current program
- † Accommodates need for imports on routine basis
- † Additional follow-up needed
- † Flexible


Approved CaRFG3 Specifications Compared to CaRFG2

Property	Flat Limits		Cap Limits	
	Current	Approved	Current	Approved
RVP, psi	7.0	7.0 ⁽¹⁾	7.0	6.4-7.2
Benzene, vol%	1.00	0.80	1.20	1.10
Sulfur, ppmw	40	20	80	60/30 ⁽²⁾
Aromatic HC, vol%	25	same	30	35
Olefins, vol. %	6.0	same	10	same
Oxygen, wt. %	1.8 to 2.2	same	0-3.5	0-3.7 ⁽³⁾
T50 °F	210	213	220	220
T90 °F	300	305	330	330

1) Equal to 6.9 psi. if using the evaporative element of the Predictive Model

2) 60 ppmw. will apply December 31, 2002; 30 ppmw. will apply December 31, 2004

3) Allow 3.7 for gasoline containing no more than 10 volume percent ethanol



CaRFG3 Program Preserves Emissions Benefits

- † CaRFG3 designed to eliminate the use of MTBE while providing refiner flexibility, preserving the existing air quality benefits of the CaRFG2 program
- † The CaRFG3 specifications result in no greater emissions of hydrocarbons, NOx and potency-weighted toxics than the CaRFG2 specifications

Expected Changes to Gasoline

- † No MTBE
- † Increased use of ethanol
- † Increased use of alkylate blending components
- † Less benzene
- † Lower sulfur content
- † Blending components similar to today's

Environmental Impacts of CaRFG3

- † MTBE contamination of water resources will be limited to pre-existing MTBE contamination prior to implementation of CaRFG3
- † Less benzene contamination of surface and ground water
- † No net increase in greenhouse gas emissions
- † Decreases in NO_x, potency weighted toxics and equivalency on hydrocarbon emissions

Environmental Policy Council Findings

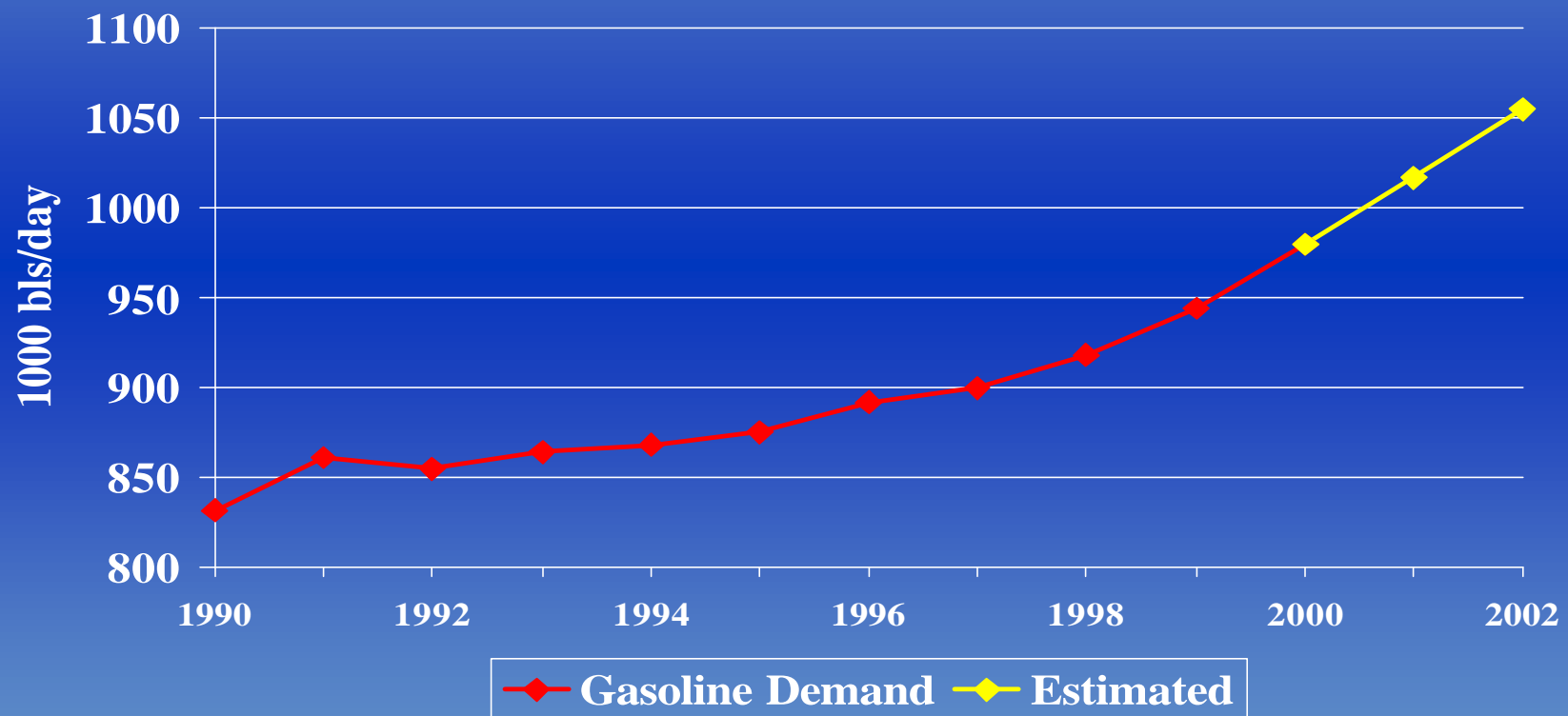


- † Found that there will be no significant adverse impact on public health or the environment, including any impact on air, water or soil, that is likely to result from the change in motor vehicle gasoline that is expected to be produced in the future

Progress to Date

- † CaRFG3 regulations approved by Environmental Policy Council on January 18, 2000
- † Submitted supplemental information for oxygenate waiver request to US EPA
- † Transmitted letter to the US EPA recommending a nationwide driveability index standard

Demand for Gasoline has Increased by 20% Since 1990



Compliance Plans

- † Initial compliance plans received
 - From refiners and pipeline distributors
- † Proposed schedules show refiners are on track for December 31, 2002
- † South Coast refiners have begun CEQA process
- † San Joaquin Valley and Bay Area refiners on track for CEQA this quarter

Future Gasoline Will Be Similar to Today's Gasoline

- † Generally gasoline will look like today's gasoline except:
 - No MTBE
 - Increased use of ethanol
 - Less benzene
 - Lower sulfur content